

**THE AEDES (*STEGOMYIA*) PSEUDONIGERIA GROUP WITH
EMPHASIS ON THE SPECIES FROM THE AFROTROPICAL REGION
(DIPTERA: CULICIDAE)¹**

by

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ABSTRACT

The *pseudonigeria* group of the subgenus *Stegomyia* Theobald (genus *Aedes* Meigen) is characterized. A key to identify the species is provided. Information on the present status of the *pseudonigeria* group of species is summarized. *Aedes (Stegomyia) mickevichae*, a new species from Kenya, is recognized. *Aedes (Stegomyia) pseudonigeria* (Theobald) from Angola is shown to be distinct and a new closely related species, *Aedes (Stegomyia) saimedres*, is recognized. The distributions of *mickevichae*, *pseudonigeria* and *saimedres* are based on examined specimens.

INTRODUCTION

This paper is part I of a revision of the subgenus *Stegomyia* Theobald (genus *Aedes* Meigen) in the Afrotropical Region. African species of *Stegomyia* have been implicated as natural hosts/ vectors/ reservoirs of eight viruses, six of which cause human illness (Chikungunya, dengue 1 and 2, Dugbe, Rift Valley Fever, yellow fever and Zika). Chikungunya, dengue and yellow fever are the most important arboviruses associated with *Stegomyia*.

Despite their medical importance, the published record on African *Stegomyia* is superficial and inadequate to accurately identify specimens that are critically needed for mosquito surveys, virus isolation studies and epidemiological studies. Insufficient material and inadequate descriptions have led to confusion and the misidentification of specimens from this area. Thus, the need for a thorough study to determine the diversity of species that occur in the area and to develop adequate and reliable methods for recognizing them became evident and has led to this taxonomic revision of African *Stegomyia*. This review is the first of a series that will eventually complete the task. Subgeneric characters and a classification of the species groups and subgroups will be discussed in a final paper.

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The present paper deals with the *pseudonigeria* group. Three African species of the *pseudonigeria* group are treated, and one species, which is unlikely to be found in the area, is included in the key.

The adult female of the three African species is described or redescribed and illustrated. Information on type data, distribution, bionomics, medical importance and a taxonomic discussion of each species are presented.

MATERIALS AND METHODS

This study is based on specimens accumulated by the Medical Entomology Project (MEP) and the Systematics of *Aedes* Mosquitoes Project (SAMP), Department of Entomology, National Museum of Natural History, Smithsonian Institution, and on specimens that were borrowed from institutions mentioned in the acknowledgments section. All primary types that are pertinent to taxa in this paper have been studied.

Distributional records are listed in the following order and format: current country names are in capital letters, administrative divisions, where known, are in italics, and place names have the first letter capitalized. Place names that could not be located in the gazetteers available are spelled according to the labels on the specimens.

The terminology follows that of Harbach and Knight (1980, 1981), with the exception of "tarsal claws," which is retained for "ungues." The venation terms follow those of Belkin (1962).

An asterisk (*) following the abbreviations used (M = male, F = female, P = pupa, L = larva and E = egg), indicates that all or some portion of that sex or stage is illustrated. The abbreviations used in the literature cited section conform to the "Serial Sources for the BIOSIS Data Base," BioSciences Information Service, Philadelphia, PA, 1982.

CHARACTERIZATION OF THE *AEDES (STEGOMYIA) PSEUDONIGERIA* GROUP

DIAGNOSIS. The *pseudonigeria* group can be distinguished from other congeners of *Stegomyia* by the following combination of characters: (1) maxillary palpi with white scales; (2) scutum with a distinct patch of broader crescent-shaped white scales on fossal area and dorsocentral setae present; (3) white knee-spot present on all femora; (4) all tibiae with a white band; (5) hindtarsus with a basal white band on tarsomeres 1, 2, tarsomere 3 with or without basal white band.

DESCRIPTION. The *pseudonigeria* group is characterized by the following combination of characters.

FEMALE. Head. Proboscis dark-scaled, without pale scales on ventral surface, longer than forefemur; maxillary palpus 0.20-0.22 length of proboscis, dark, with white scales on apical 0.33-0.50; pedicel covered with white scales except on dorsal and ventral surfaces; clypeus bare; occiput with few pale or dark erect forked scales; a row of broad white scales around eye margins; vertex with a median stripe of broad white scales, with broad dark scales

on each side interrupted by a lateral stripe of broad white scales, followed ventrally by a patch of broad white scales. Thorax. Scutum with narrow dark scales and a distinct, median white spot of broad or narrow scales on anterior promontory, followed by a narrow median longitudinal stripe of narrow white scales, median white stripe reaching to prescutellar area; prescutellar white lines present or absent; fossal area with a large patch of broader crescent-shaped white scales; posterior dorsocentral white lines present and reaching to posterior 0.33-0.50 of scutum; a patch of narrow white scales on lateral margin just in front of wing root; acrostichal setae absent; dorsocentral setae present; scutellum with broad white scales on all lobes and with a few broad dark scales at apex of midlobe; antepronotum with broad white scales; postpronotum with a patch of broad white scales and a few dark narrow scales dorsally; paratergite with broad white scales; postspiracular area without scales; hypostigmal area with or without broad white scales; patches of broad white scales on propleuron, subspiracular area, upper and lower portions of mesokatepisternum, and on mesepimeron; upper mesokatepisternal scale patch not reaching to anterior corner of mesokatepisternum; upper mesepimeral scale patch connecting with lower mesepimeral scale patch; lower mesepimeron without setae; metameron with or without broad white scales. Wing. With dark scales on all veins except for a minute basal spot of white scales on costa; cell R_2 1.4-2.2 length of R_{2+3} . Halter. With dark scales, or with dark and white scales. Legs. Coxae with patches of white scales; white knee-spot present on all femora; forefemur anteriorly dark with a narrow, white longitudinal stripe on ventral surface in basal 0.33-0.50, or forefemur anteriorly with some pale scales scattered; midfemur anteriorly with some pale scales scattered, or midfemur anteriorly with some pale scales scattered in basal 0.66 and with a larger white patch near base; hindfemur anteriorly with a broad, white longitudinal stripe in basal 0.51-0.75 that widens at base, or hindfemur anteriorly with a broad, white longitudinal stripe in basal 0.60 that widens 0.33 from base; all tibiae anteriorly dark, each with a subbasal white band; those on mid- and hindtibiae incomplete dorsally; hindtibia with subbasal white band on ventral surface in basal 0.20; or all tibiae with a white band incomplete ventrally, fore- and midtibiae with white bands (incomplete ventrally) about 0.33 from base and hindtibia with a white band (incomplete ventrally) about 0.40 from base; fore- and midtarsi with a basal white band on tarsomeres 1, 2, or 1-3; hindtarsus with a basal white band on tarsomeres 1, 2; hindtarsomere 3 with basal white band or all dark; hindtarsomere 4 with basal white band or all white; hindtarsomere 5 all white or all dark; fore- and midlegs with tarsal claws equal, all simple or all toothed; hindleg with tarsal claws equal, both simple. Abdomen. Tergum I with white scales on laterotergite; terga II-VII each with a basal white band and basolateral white spots which do not connect, or tergum VII with basolateral white spots only; basal white bands with or without apicomedian emargination; sterna III-VI each with a basal white band; sternum VII with a basal white band and basolateral white spots, or sternum VII with basolateral white spots only; segment VIII completely retracted. Genitalia. Apical margin of sternum VIII with a deep U-shaped notch at middle and with conspicuous rounded lateral lobes; insula longer than wide, with minute setae and with 6-8 larger setae on apical 0.50; tergum IX broader than long, apical margin of tergum IX with well developed lateral lobes, each with 2-6 setae; apical margin of postgenital plate with very shallow or without median notch; cercus short and broad; 3 spermathecae, one larger than the other 2.

DISTRIBUTION. Three members of the *pseudonigeria* group occur in the Afrotropical Region. They are found in southwestern (Angola), southern (Namibia, Botswana) and eastern (Kenya) Africa (Fig. 1). One species is found in the Palearctic Region (N.E. China and Korea).

TAXONOMIC DISCUSSION. The *pseudonigeria* group includes *pseudonigeria* (Theobald) 1910 from Angola, 2 new Afrotropical species, *mickevichae* from Kenya and *saimedres* from Namibia (S.W. Africa) and the Palearctic species, *chemulpoensis* Yamada 1921 from Korea.

Edwards (1932) divided the subgenus *Stegomyia* into four groups and assigned *Ae. chemulpoensis* to Group B (*w-albus* group). Mattingly (1953) transferred *Ae. chemulpoensis* from Group B to Group A (*aegypti* group), and Huang (1974) concurred with this assignment. Mattingly (1965) subdivided Group A into 3 subgroups known as Subgroup A1 (*Ae. aegypti* subgroup), Subgroup A2 (*Ae. africanus* subgroup) and Subgroup A3 (*Ae. chemulpoensis* subgroup). In "Subgroup A1 (*Ae. aegypti* subgroup)" he included 28 species from the Mascarenes and Africa. *Aedes pseudonigeria* was assigned by Mattingly (1965:22) to his Subgroup A1. In "Subgroup A3 (*Ae. chemulpoensis* subgroup)" he included only one species, *Ae. chemulpoensis* from N.E. China and Korea. The remarkable discontinuous distribution of the group may be altered by the discovery of forms in intermediate areas.

The *pseudonigeria* group shows affinities with the *aegypti* group but can be distinguished easily from the latter by the presence of a white band, sometimes incomplete, on all tibiae. Males and immature stages of the African species of the *pseudonigeria* group are unknown.

The ornamentation of the adults of African species of the *pseudonigeria* group is essentially as in *chemulpoensis*. However, the African members of the *pseudonigeria* group can be distinguished easily from that of *chemulpoensis* by: (1) all tibiae with a subbasal white band (complete or incomplete dorsally, rather close to the base); (2) hindtarsomere 4 all white; and (3) female fore- and midlegs with tarsal claws equal and toothed. In *chemulpoensis*, all tibiae with a white band (incomplete ventrally, rather removed from the base), the fore- and midtibiae have white bands about 0.33 from base and the hindtibia has a white band about 0.40 from base, the hindtarsomere 4 is 0.63 or less basally white, and female the fore- and midtarsal claws which are equal and simple; male the fore- and midtarsal claws which are unequal and simple (see Fig. 5). This group may have been widespread. Therefore, the Palearctic species is only provisionally associated with the *pseudonigeria* group pending a study of the male and the immature stages of the latter.

Theobald (1910:163) described *Stegomyia wellmanii* from 3 females that were caught at a tent lamp at 8 pm in Bailunder, Angola, and in the same publication (Theobald 1910:166) he described *Stegomyia pseudonigeria* from 3 females, one taken in the open at sunset, in Owambu, Angola. Edwards (1912:3) considered these two species to be conspecific and stated that "The name *pseudonigeria* is used for this species, because *Danielsia wellmani* Theobald (1905a:103) known only from the female, may be a *Stegomyia* and not an *Ochlerotatus*. In any case it would be well not to duplicate specific names in the *Aedes* group."

Edwards (1941:147) treated *Aedes (Stegomyia) pseudonigeria* (Theobald) as a single species and described the female as having the "...last two segments of hind tarsi almost entirely white." In the distribution section of Edwards' paper he also included localities from Bechuanaland (Ngamiland) and S.W. Africa (Ovamboland) in addition to the type locality, Angola (Bailunder, Owambu). In a discussion on variation, however, Edwards (1941:148) noted that: "The specimens from Ovamboland have the last hind tarsal segment black instead of white" and regarded them as variation (the specimens from S.W. Africa have hindtarsomere 5 all dark varies from the type form from Angola which has hindtarsomere 5 all white). Mattingly (1953:35) suggested that the form from the Angola highland may be a distinct subspecies. Muspratt (1956:74) redescribed *Aedes (Stegomyia) pseudonigeria* from females that were collected in S.W. Africa (Okokarara, Okahandja, Otjiwarongo, Kanovlei) and Bechuanaland

(Francistown) and mentioned that the specimens from S.W. Africa and Francistown have hindtarsomere 5 all dark or white at base. In a discussion (Muspratt 1956:75) on variation, however, he also noted that the specimens from S.W. Africa with hindtarsomere 5 all dark varied from the type form from Angola, which has hindtarsomere 5 all white, and considered both forms as *Aedes (Stegomyia) pseudonigeria*.

Based on a detailed morphological study of pertinent specimens, it is now apparent that the so-called "*pseudonigeria*" from S.W. Africa, which has hindtarsomere 5 all dark, is not conspecific with specimens from Angola. To the contrary, my study indicates that the specimens from S.W. Africa represent a new species that is distinct from the type form from Angola, which has hindtarsomere 5 all white. Therefore, I recognize a new species, *Ae. saimedres*, for the form from Namibia (S.W. Africa), which has hindtarsomere 3 with basal 0.2-0.25 white on dorsal surface, hindtarsomere 4 all white and hindtarsomere 5 all dark, and *Ae. pseudonigeria* species from Angola, which has hindtarsomere 3 with basal 0.33 white on dorsal surface, hindtarsomeres 4, 5 all white. The new species, *saimedres*, is most closely related and similar to *pseudonigeria*, and I consider *saimedres* to be the sister species of *pseudonigeria*.

In addition, a new species, *Ae. mickevichae*, from Kenya is also recognized. *Aedes mickevichae* combines some of the features of the African species, *pseudonigeria* and *saimedres*, and the Palearctic species, *chemulpoensis*. These species form a unique group and share the above mentioned characters.

REMARKS. The name *Ae. pseudonigeria* has been misused. I have not examined the following specimens of *Ae. pseudonigeria* from Southwest Africa (Ovamboland, in Edwards 1941:148; Otjiverongo, in Edwards 1924:159; Otiwarongo and Kanovlei, in Muspratt 1956:116), South Africa (Transval and Matlabas River, in Muspratt 1956:122) and from Angola (Nova Lisboa and Sa da Bandeira, in Ribeiro and Ramos 1973:123). Records of this species from Southwest Africa and South Africa by Edwards (1924, 1941) and by Muspratt (1956) may refer to *saimedres*.

BIONOMICS. The biology of African species of *pseudonigeria* is unknown. The larvae of *chemulpoensis* have been collected from tree holes in Korea (Tanaka et al. 1979:405). Females of 3 species, *mickevichae*, *pseudonigeria*, *saimedres*, are known to bite man.

MEDICAL IMPORTANCE. Nothing is known of the role of these species as vectors of pathogens. As females of all African *Stegomyia* species readily attack man and can be abundant near villages and plantations, they should be considered of potential public health importance.

KEY TO THE SPECIES OF THE *PSEUDONIGERIA* GROUP
MALES AND FEMALES²

1. Scutum with anterior median white spot of broad scales (Figs. 2A, 3A) 2.
- Scutum with anterior median white spot of narrow scales (Fig. 2C) 3.
- 2(1). Hindtarsomere 3 with basal 0.33 white on dorsal surface; hindtarsomere 5 all white (Fig. 3D). *pseudonigeria* (Theobald).
- Hindtarsomere 3 with basal 0.25 or less white on dorsal surface; hindtarsomere 5 all dark (Fig. 2B) *saimedres* n. sp.
- 3(1). Hindtarsomere 3 all dark; hindtarsomere 4 all white; hindtarsomere 5 all dark (Fig. 2D)... *mickevichae* n. sp.
- Hindtarsomere 3 with basal 0.33 or more white on dorsal surface; hindtarsomere 4 with basal 0.63 or less white on dorsal surface; hindtarsomere 5 all white (Fig. 5). *chemulpoensis* Yamada.³

DESCRIPTIONS OF THE SPECIES OCCURRING IN THE AFROTROPICAL REGION

AEDES (STEGOMYIA) MICKEVICHAE NEW SPECIES
(Figs. 2C, D)

FEMALE. Head. Proboscis dark-scaled, without pale scales on ventral surface, longer than forefemur; maxillary palpus 0.22 length of proboscis, dark, with white scales on apical 0.33; pedicel covered with white scales except on dorsal and ventral surfaces; clypeus bare; occiput with few pale erect forked scales; a row of broad white scales around eye margins; vertex with a broad, median stripe of broad white scales, with broad dark scales on each side interrupted by a lateral stripe of broad white scales, followed ventrally by a patch of broad white scales. Thorax (Fig. 2C). Scutum with narrow dark scales and a distinct, median white spot of narrow scales on anterior promontory, followed by a narrow median longitudinal stripe of narrow white scales, median white stripe reaching to prescutellar area; prescutellar white lines present; fossal area with a large patch of broader crescent-shaped white scales; posterior dorsocentral white lines present, reaching to posterior 0.33 of scutum; a patch of narrow white scales on lateral margin just in front of wing root; acrostichal setae absent; dorsocentral setae present; scutellum with broad white scales on all lobes and with a few broad dark scales at apex of midlobe; antepronotum with broad white scales; postpronotum with a patch of broad white scales and a few dark narrow scales dorsally; paratergite with broad white scales; postspiracular area without scales; hypostigmal area without scales; patches of broad white scales

² The males of *mickevichae*, *pseudonigeria* and *saimedres* are unknown.

³ Palearctic species.

on propleuron, subspiracular area, upper and lower portions of mesokatepisternum, and on mesepimeron; upper mesokatepisternal scale patch not reaching to anterior corner of mesokatepisternum; upper mesepimeral scale patch connecting with lower mesepimeral scale patch; lower mesepimeron without setae; metameron with broad white scales. Wing. With dark scales on all veins except for a minute basal spot of white scales on costa; cell R_2 1.4 length of R_{2+3} . Halter. With dark and white scales. Legs (Fig. 2D). Coxae with patches of white scales; white knee-spot present on all femora; forefemur anteriorly with some pale scales scattered in basal 0.50; midfemur anteriorly with some pale scales scattered in basal 0.66 and with a larger white patch near base; hindfemur anteriorly with a broad, white longitudinal stripe in basal 0.60 that widens 0.33 from base; all tibiae anteriorly dark, each with a subbasal white band; hindtibia with subbasal white band on ventral surface rather long, occupying basal 0.20; fore- and midtarsi with a basal white band on tarsomeres 1, 2; foretarsomere 1 with basal 0.25 white on dorsal surface, and tarsomere 2 with basal 0.50 white on dorsal surface; midtarsomere 1 with basal 0.66 white on dorsal surface, and tarsomere 2 with basal 0.66 white on dorsal surface; hindtarsus with a basal white band on tarsomeres 1, 2, the ratio of length of white band on dorsal surface to the total length of tarsomere is 0.33, and 0.40; hindtarsomeres 3, 5 all dark; hindtarsomere 4 all white, with a few dark scales at apex on ventral surface; fore- and midlegs with tarsal claws equal, all toothed; hindleg with tarsal claws equal, both simple. Abdomen. Tergum I with white scales on laterotergite; terga II-VII each with a basal white band and basolateral white spots not connecting with basal white band; basal white band usually emarginate at middle on each of terga II-VI; sterna III-VI each with a basal white band; sternum VII with basolateral white spots; segment VIII completely retracted.

MALE, PUPA and LARVA. Unknown.

TYPE DATA. Holotype female (MEP Acc. 719/ Kaunro, KENYA, $38^{\circ} 12' E$, $00^{\circ} 08' S$, Tana River, 3. 11. 61/ D. Minter, biting), Kaunro, KENYA, III-11-1961 (D. Minter). Deposited in the British Museum (Natural History), London [BMNH]. 1 paratype female (MEP Acc. 719), same data as holotype, biting, XII-1960 (D. Minter). Deposited in the BMNH.

DISTRIBUTION (Fig. 1). This species is presently known only from the Type locality, Kaunro, Eastern Region of Kenya.

ETYMOLOGY. This species is named to honor Dr. Mary F. Mickevich, Faculty, University of Maryland and Professor of Maryland Center for Systematic Entomology, at the Department of Entomology, Smithsonian Institution, in recognition and appreciation of her contributions to our knowledge of the phylogeny of *Stegomyia*.

TAXONOMIC DISCUSSION. *Aedes mickevichae* differs from congeners of the *pseudonigeria* group by the following combination of characters: (1) scutum with anterior median white spot of narrow scales; (2) hindtarsomere 3 all dark; (3) hindtarsomere 4 all white; and (4) hindtarsomere 5 all dark.

The adult of *Ae. mickevichae* is not only morphologically very similar to those of African species: *pseudonigeria* and *saimedres* but also to that of Palearctic species, *Ae. chemulpoensis*. The female of *Ae. mickevichae* is very similar to those of *pseudonigeria* and *saimedres* in having all tibiae with a subbasal white band and hindtarsomere 4 all white but can be separated from *pseudonigeria* and *saimedres* by: (1) scutum with anterior median white spot of narrow scales; and (2) hindtarsomere 3 all dark. It is also very similar to that of *chemulpoensis* in having scutum with anterior median white spot of narrow scales. However, it can easily be

distinguished from *chemulpoensis* by: (1) hindtarsomere 3 all dark; (2) hindtarsomere 4 all white; and hindtarsomere 5 all dark. In *chemulpoensis*, the hindtarsomere 3 is 0.33 or more basally white, the hindtarsomere 4 is 0.63 or less basally white, and the hindtarsomere 5 is all white.

Aedes mickevichae superficially resembles *Aedes (Stegomyia) amaltheus* de Meillon and Lavoipierre 1944 and *Aedes (Stegomyia) masseyi* Edwards 1923, in the scutal and hindtarsus markings. However, *Ae. mickevichae* differs from *amaltheus* and *masseyi* by: (1) white knee-spot present on all femora; (2) midfemur anteriorly with some pale scales scattered in basal 0.66 and with a larger white patch near base; and (3) all tibiae with a subbasal white band. In *amaltheus* and *masseyi*, the white knee-spot is absent on forefemur, present on mid- and hindfemora; the midfemur is dark, without scattered pale scales on anterior surface; the fore-tibia has a basal white band, mid- and hindtibiae are dark, without basal or subbasal white stripe or band.

BIONOMICS. Females of this species have been taken while biting man in Kaunro, Kenya.

AEDES (STEGOMYIA) PSEUDONIGERIA (THEOBALD)
(Fig. 3)

Stegomyia wellmanni Theobald 1910:163 (F*).

Stegomyia pseudonigeria Theobald 1910:166 (F*); Edwards 1912:3 (F, Nomenclature).

Aedes (Stegomyia) pseudonigeria (Theobald), Edwards 1941:147 (F); Mattingly 1953:6,18 (taxonomy, distribution; in part); Ribeiro and Ramos 1973:123 (taxonomy, distribution and bionomics).

FEMALE (Fig. 3). **Head.** Proboscis dark-scaled, without pale scales on ventral surface, longer than forefemur; maxillary palpus 0.22 length of proboscis, dark, with white scales on apical 0.50; pedicel covered with white scales except on dorsal and ventral surfaces; clypeus bare; occiput with few pale erect forked scales; a row of broad white scales around eye margins; vertex with a median stripe of broad white scales, with broad dark scales on each side interrupted by a lateral stripe of broad white scales, followed ventrally by a patch of broad white scales. **Thorax** (Figs. 3A, B). Scutum with narrow dark scales and a distinct, median white spot of broad scales on anterior promontory, followed by a narrow median longitudinal stripe of narrow white scales, median white stripe reaching to prescutellar area; prescutellar white lines usually present; fossal area with a large patch of broader crescent-shaped white scales; posterior dorsocentral white lines present and reaching to posterior 0.40 of scutum; a patch of narrow white scales on lateral margin just in front of wing root; acrostichal setae absent; dorsocentral setae present; scutellum with broad white scales on all lobes and with a few broad dark scales at apex of midlobe; antepronotum with broad white scales; postpronotum with a large patch of broad white scales and a few dark narrow scales dorsally; paratergite with broad white scales; postspiracular area without scales; hypostigmal area with broad white scales; patches of broad white scales on propleuron, subspiracular area, upper and lower portions of mesokatepisternum, and on mesepimeron; upper mesokatepisternal scale patch not reaching to anterior corner of mesokatepisternum; upper mesepimeral scale patch connecting with lower mesepimeral scale patch; lower mesepimeron without setae; metameron with broad white scales. **Wing** (Fig. 3C). With dark scales on all veins except for a minute basal spot of white scales on costa; cell R_2 2.0-2.2 length of R_{2+3} . **Halter.** With white and some dark scales. **Legs** (Fig. 3D). Coxae with patches of white scales; white knee-spot present on all

femora; forefemur anteriorly with a narrow, white longitudinal stripe on ventral surface in basal 0.33; midfemur anteriorly with some pale scales scattered and sometimes with a larger white patch near base; hindfemur anteriorly with a broad, white longitudinal stripe in basal 0.60-0.66 that widens at base; all tibiae anteriorly dark, each with a subbasal white band; those on mid- and hindtibiae incomplete dorsally; fore- and midtarsi with a basal white band on tarsomeres 1, 2; foretarsomere 1 with basal 0.20-0.25 white on dorsal surface, and tarsomere 2 with basal 0.33-0.40 white on dorsal surface; midtarsomere 1 with basal 0.25-0.30 white on dorsal surface, and tarsomere 2 with basal 0.33-0.40 white on dorsal surface; hindtarsus with a basal white band on tarsomeres 1-3, the ratio of length of white band on dorsal surface to the total length of tarsomere is 0.33, 0.33, and 0.33; hindtarsomeres 4, 5 all white; fore- and midlegs with tarsal claws equal, all toothed; hindleg with tarsal claws equal, both simple. Abdomen (Figs. 3E, F). Tergum I with white scales on laterotergite; terga II-VII each with a basal white band and basolateral white spots not connecting with basal white band; basal white band usually emarginate at middle on each of terga II-VI; sterna III-VII each with a basal white band; sternum VII with basolateral white spots as well; segment VIII completely retracted.

MALE, PUPA and LARVA. Unknown.

TYPE DATA. *Stegomyia wellmanii* Theobald, type female in BMNH; type locality: Bailunder = Bailundo ($12^{\circ} 15'$ S, $16^{\circ} 50'$ E), ANGOLA, III-30-1905 (Dr. C. Wellman). *Stegomyia pseudonigeria* Theobald, 2 cotype females in BMNH; type locality: Owambu = Nova Lisboa ($12^{\circ} 45'$ S, $15^{\circ} 48'$ E), ANGOLA, IV-3-1905 (Dr. C. Wellman).

OTHER MATERIAL EXAMINED. ANGOLA. no data except Angola, 2 F [BMNH]. BOTSWANA (Bechuanaland). Bottle River ($20^{\circ} 12'$ S, $24^{\circ} 20'$ E), (Ngamiland), Bechuanaland Protectorate, II-1909, Dr. R. U. Moffat, 2 F (MEP Acc. 778) [BMNH].

DISTRIBUTION (Fig. 1). This species is presently known only from Angola. Edwards (1941:148) recorded *pseudonigeria* from Bottle River, Ngamiland (Moffat), Bechuanaland. The two female specimens from Ngamiland (Moffat), in the BMNH, are in very poor condition. Both females have all hindlegs missing and the specific identification is not possible; therefore, this record can not be confirmed until additional specimens of Ngamiland become available.

TAXONOMIC DISCUSSION. *Aedes pseudonigeria* has white knee-spot present on all femora and all tibiae with a white band, and can thus easily be distinguished from all other species of *Stegomyia* except those of *mickevichae*, *saimedres*, and *chemulpoensis*. However, *Ae. pseudonigeria* differs from all other members of the *pseudonigeria* group by the following combination of characters: (1) scutum with anterior median white spot of broad scales; (2) hindtarsomere 3 with basal 0.33 white on dorsal surface; (3) hindtarsomere 4 all white; and (4) hindtarsomere 5 all white.

The female of *Ae. pseudonigeria* is very similar to those of African species: *mickevichae* and *saimedres*. In *mickevichae*, the scutum has anterior median white spot of narrow scales and the hindtarsomeres 3 and 5 are entirely dark. In *saimedres*, the hindtarsomere 3 is 0.20-0.25 basally white and the hindtarsomere 5 is all dark.

The female of *Ae. pseudonigeria* is also very similar to that of the Palearctic *Ae. chemulpoensis*. In *chemulpoensis*, the scutum has anterior median white spot of narrow scales, the fore- and midtibiae have white bands (incomplete ventrally) about 0.33 from base and

hindtibia has a white band (incomplete ventrally) about 0.40 from base, the hindtarsomere 4 is 0.63 or less basally white, and female the fore- and midtarsal claws which are equal and simple; male the fore- and midtarsal claws which are unequal and simple.

Aedes pseudonigeria is apparently a highland species. In Angola, it has been collected at altitudes from 1,700-1,900 m (5,100-5,700 ft) with yearly rainfall of 152.4-177.8 cm (60-70 in).

BIONOMICS. Mattingly (1953:30) reported that according to Dr. Wellman, this species is a persistent and vicious biter. One specimen in the BMNH is marked as taken out of doors in a village at 5 p.m. and as a common domestic mosquito biting by day. Others are marked as taken at house or tent lamps at 8 p.m. Ribeiro and Ramos (1973:123) reported that in Angola, *Ae. pseudonigeria* is a vicious man-biting species, one of their females having been caught on human bait.

AEDES (STEGOMYIA) SAIMEDRES NEW SPECIES
(Figs. 2A, B; 4)

Aedes (Stegomyia) pseudonigeria of Mattingly 1953:6,18 (taxonomy, distribution; in part); Muspratt 1956:74 (F*).

FEMALE. Head. Proboscis dark-scaled, without pale scales on ventral surface, longer than forefemur; maxillary palpus 0.20-0.22 length of proboscis, dark, with white scales on apical 0.33; pedicel covered with white scales except on dorsal and ventral surfaces; clypeus bare; occiput with few dark erect forked scales; a row of broad white scales around eye margins; vertex with a median stripe of broad white scales, with broad dark scales on each side interrupted by a lateral stripe of broad white scales, followed ventrally by a patch of broad white scales. Thorax (Fig. 2A). Scutum with narrow dark scales and a distinct, median white spot of broad scales on anterior promontory, followed by a narrow median longitudinal stripe of narrow white scales, median white stripe reaching to prescutellar area; prescutellar white lines not present; fossal area with a large patch of broader crescent-shaped white scales; posterior dorsocentral white lines reaching to posterior 0.33 of scutum; a patch of narrow white scales on lateral margin just in front of wing root; acrostichal setae absent; dorsocentral setae present; scutellum with broad white scales on all lobes and with a few broad dark scales at apex of midlobe; antepronotum with broad white scales; postpronotum with a patch of broad white scales and a few dark narrow scales dorsally; paratergite with broad white scales; postspiracular area without scales; hypostigmal area without scales; patches of broad white scales on propleuron, subspiracular area, upper and lower portions of mesokatepisternum, and on mesepimeron; upper mesokatepisternal scale patch not reaching to anterior corner of mesokatepisternum; upper mesepimeral scale patch connecting with lower mesepimeral scale patch; lower mesepimeron without setae; metameron bare. Wing. With dark scales on all veins except for a minute basal spot of white scales on costa; cell R_2 1.4-1.5 length of R_{2+3} . Halter. With dark and white scales. Legs (Fig. 2B). Coxae with patches of white scales; white knee-spot present on all femora; forefemur anteriorly with a narrow, white longitudinal stripe on ventral surface in basal 0.33; midfemur anteriorly with some pale scales scattered, and with a larger white patch near base; hindfemur anteriorly with a broad, white longitudinal stripe in basal 0.51-0.61 that widens at base; all tibiae anteriorly dark, each with a subbasal white band; those on mid- and hindtibiae incomplete dorsally; fore- and midtarsi with a basal white band on tarsomeres 1, 2; foretarsomere 1 with basal 0.22-0.25 white on dorsal surface, and tarsomere 2 with basal 0.33-0.46 white on dorsal surface; midtarsomere 1 with basal 0.24-0.33

white on dorsal surface, and tarsomere 2 with basal 0.33-0.45 white on dorsal surface; hindtarsus with a basal white band on tarsomeres 1-3, the ratio of length of white band on dorsal surface to the total length of tarsomere is 0.25-0.30, 0.25-0.28, and 0.20-0.25; hindtarsomere 4 all white, with few dark scales at apex on ventral surface; hindtarsomere 5 all dark; fore- and midlegs with tarsal claws equal, all toothed; hindleg with tarsal claws equal, both simple. Abdomen. Tergum I with white scales on laterotergite; terga II-VI each with a basal white band and basolateral white spots not connecting with basal white band; tergum VII with basolateral white spots; sterna III-VI each with a basal white band; sternum VII with basolateral white spots; segment VIII completely retracted. Genitalia (Fig. 4). Apical margin of sternum VIII with a deep U-shaped notch at middle and with conspicuous rounded lateral lobes; insula longer than wide, with minute setae and with 6 (6-8) larger setae on apical 0.50; tergum IX broader than long, apical margin of tergum IX with well developed lateral lobes, each with 4 or 5 (2-6) setae; apical margin of postgenital plate with very shallow or without median notch; cercus short and broad; 3 spermathecae, one larger than the other 2.

MALE, PUPA and LARVA. Unknown.

TYPE DATA. Holotype female (MEP Acc. 719/ SW128/ S.A.I.M.R. A13/50, Coll. No. SW128), Okokarara ($20^{\circ} 35' S$, $17^{\circ} 27' E$), NAMIBIA (South West Africa), 1950 (B. de Meillon). Deposited in British Museum (Natural History), London. Paratypes: 6 females, 3 female genitalia (MEP Acc. 802/ SW128/ 87/117, 87/118, 87/111), same data as holotype. Deposited in the South African Institute for Medical Research, Johannesburg, South Africa [SAIM].

OTHER MATERIAL EXAMINED. NAMIBIA (South West Africa). Okahandja ($21^{\circ} 59' S$, $16^{\circ} 56' E$), 1950, B. de Meillon, 2 F, 1 F gen (MEP Acc. 802/ SW52/ 87/116) [SAIM]. BOTSWANA (Bechuanaland). Francistown ($21^{\circ} 13' S$, $27^{\circ} 30' E$), 1952, B. de Meillon, 1 F (MEP Acc. 802/ S.A.I.M.R. A1/52, Coll. No. 8A) [SAIM].

DISTRIBUTION (Fig. 1). This species is presently known from Namibia (South West Africa) and Botswana (Bechuanaland).

ETYMOLOGY. This species is named (SAIMEDRES used as noun) for The South African Institute for Medical Research, Johannesburg, South Africa, in recognition and appreciation of the valuable contribution that the Department of Medical Entomology has made to our knowledge of the mosquito fauna of Africa.

TAXONOMIC DISCUSSION. The female of *Ae. saimedres* is extremely similar to that of *Ae. pseudonigeria* with which it has been confused and misidentified. However, *Ae. saimedres* can easily be distinguished from *pseudonigeria* by the diagnostic characters mentioned under the discussion of *pseudonigeria*.

A study of the specimens from Francistown and S.W. Africa indicated that the female specimen from Francistown (de Meillon) shares the same characteristics of the female specimens from S.W. Africa (de Meillon) in all respects (such as: occiput with few dark erect forked scales, basal white band not emarginate at middle on each of terga II-VI, and hindtarsomere 3 with basal 0.20 white on dorsal surface) except in hindtarsomere 5 markings. The female specimen from Francistown has hindtarsomere 5 all dark with some white scales at the base (the white scales at base do not form a complete band). The specimens from S.W. Africa have hindtarsomere 5 all dark. Because the female specimen from Francistown agrees

well with the female specimens from S.W. Africa, I consider that these are the same species and that the character (hindtarsomere 5 all dark or with some white scales at base) is variable.

The female of *Ae. saimedres* is also very similar to that of *mickevichae*. In *mickevichae*, the scutum has anterior median white spot of narrow scales and the hindtarsomere 3 is all dark. *Aedes saimedres* is also very similar to that of *chemulpoensis* and can be separated from *chemulpoensis* by: (1) scutum with anterior median white spot of broad scales; (2) all tibiae with a subbasal white band; (3) hindtarsomere 4 all white; (4) hindtarsomere 5 all dark; and (5) female fore- and midlegs with tarsal claws equal and toothed. In *chemulpoensis*, the scutum has anterior median white spot of narrow scales, the fore- and midtibiae have white bands about 0.33 from base and hindtibia has white band about 0.40 from base, the hindtarsomere 4 is 0.63 or less basally white, the hindtarsomere 5 is all white, and female the fore- and midtarsal claws which are equal and simple; male the fore- and midtarsal claws which are unequal and simple.

The female of *Ae. saimedres* is also somewhat similar to that of *Aedes (Stegomyia) poweri* (Theobald) 1905b, in scutal, pleural and hindtarsus markings and can be confused with this species. However, *Ae. saimedres* differs from *poweri* by: (1) white knee-spot present on all femora; (2) midfemur without a distinct large white spot on anterior surface about 0.60 from base; and (3) all tibiae with a subbasal white band. In *poweri*, the white knee-spot is absent on the forefemur but present on the mid- and hindfemora; the midfemur has a distinct large white spot on anterior surface about 0.60 from base; and the foretibia has a basal white band, midtibia has a distinct white stripe on ventral surface in basal 0.14-0.17, and hindtibia has a white longitudinal stripe on ventral surface in basal 0.25-0.33.

Aedes saimedres is apparently a common species in Namibia (S. W. Africa). Based on the present collection data, *Ae. saimedres* has been collected between 1,100 and 1,500 m (3,300-4,500 ft) with yearly rainfall of 38.1-50.8 cm (15-20 in).

BIONOMICS. Mattingly (1953:30) stated that according to Muspratt *Ae. pseudonigeria* was taken biting by de Meillon in Namibia (S. W. Africa). Muspratt (1956:75) reported that the female specimens of this species were all taken biting; however, Muspratt's *pseudonigeria* is not *pseudonigeria*, but is the new species *saimedres*.

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LITERATURE CITED

BELKIN, J. N. 1962. The mosquitoes of the South Pacific (Diptera, Culicidae). University of California Press, Berkeley and Los Angeles. 2 vols., 608 and 412 pp.

EDWARDS, F. W. 1912. A synopsis of the species of African Culicidae, other than *Anopheles*. Bull. Entomol. Res. 3: 1-53.

1923. Four new African mosquitoes. Bull. Entomol. Res 13: 397-399.

1924. Some mosquitoes from Ovamboland, S.W. Africa and from the Cape Province. Ann. S. Afr. Mus. 19:159-163.

1932. Diptera. Fam. Culicidae. In: P. Wytsman, Genera Insectorum, Desmet-Verteneuil, Brussels, Fasc. 194, 258 p., 5 pl.

1941. Mosquitoes of the Ethiopian region. III. Culicine adults and pupae. Br. Mus. (Nat.Hist.), London. 499 p.

DE MEILLON, B. and M. LAVOPIERRE. 1944. New records and species of biting insects from the Ethiopian region. J. Entomol. Soc. S. Afr. 7:38-67.

HARBACH, R. E. and K. L. KNIGHT. 1980. Taxonomists' glossary of mosquito anatomy. Plexus Publishing, Inc., Marlton, N.J. 415 pp.

1981(1982). Corrections and additions to taxonomists' glossary of mosquito anatomy. Mosq. Syst. 13:201-217.

HUANG, Y. M. 1974. Lectotype designation for *Aedes (Stegomyia) chemulpoensis* Yamada with a note on its assignment to the *aegypti* group of species (Diptera: Culicidae). Proc. Entomol. Soc. Wash. 76: 208-211.

MATTINGLY, P. F. 1953. The sub-genus *Stegomyia* (Diptera: Culicidae) in the Ethiopian region. II. Distribution of species confined to the east and south African sub-region. Bull. Br. Mus. (Nat. Hist.), Entomol. London 3:1-65.

1965. The culicine mosquitoes of the Indomalayan Area. Part VI. Genus *Aedes* Meigen, subgenus *Stegomyia* Theobald (Groups A, B and D). Br. Mus. (Nat. Hist.), London. 67 p.

MUSPRATT, J. 1956. The *Stegomyia* mosquitoes of South Africa and some neighboring territories. Mem. Entomol. Soc. S.Afr. 4: 1-138.

RIBEIRO, H. and H. DA C. RAMOS. 1973. Research on the mosquitoes of Angola VIII. The genus *Aedes* Meigen, 1818 (Diptera: Culicidae). Check-list with new records, keys to females and larvae, distribution and taxonomic and bioecological notes. An. Inst. Hig. Med. Trop. 1: 107-138.

TANAKA, K., K. MIZUSAWA and E. S. SAUGSTAD. 1979. A revision of the adult and larval mosquitoes of Japan (including the Ryukyu Archipelago and the Ogasawara Islands) and Korea (Diptera: Culicidae). *Contrib. Am. Entomol. Inst.* (Ann Arbor). 16:1-987.

THEOBALD, F. V. 1905a. New Culicidae from the west coast of Africa. *Entomologist* 38: 101-104, 154-158.

1905b. New Culicidae from India, Africa, British Guiana, and Australia. *J. Entomol. Biol.* 1: 17-36, 2 pl.

1910. A monograph of the Culicidae or mosquitoes. Vol.V, *Br. Mus. (Nat. Hist.)*, London. 646 p., 6 pl.

YAMADA, S. 1921. Descriptions of ten new species of *Aedes* found in Japan, with notes on the relation between some of these mosquitoes and the larva of *Filaria bancrofti* Cobbold. *Annot. Zool. Jap.* 10: 45-81.

LIST OF FIGURES

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2. *Aedes (Stegomyia) mickevichae* Huang, n. sp. - C, thorax (dorsal view); D, female fore-, mid- and hindlegs (anterior view); *Aedes (Stegomyia) saimedres* Huang, n. sp. - A, thorax (dorsal view); B, female fore-, mid- and hindlegs (anterior view).
3. *Aedes (Stegomyia) pseudonigeria* (Theobald) - A, B, C, D, E, F, female adult (Type).
4. *Aedes (Stegomyia) saimedres* Huang, n. sp. - A, B, C, D, female genitalia.
5. *Aedes (Stegomyia) chemulpoensis* Yamada - male fore-, mid- and hindlegs (anterior view).

Fig. 1

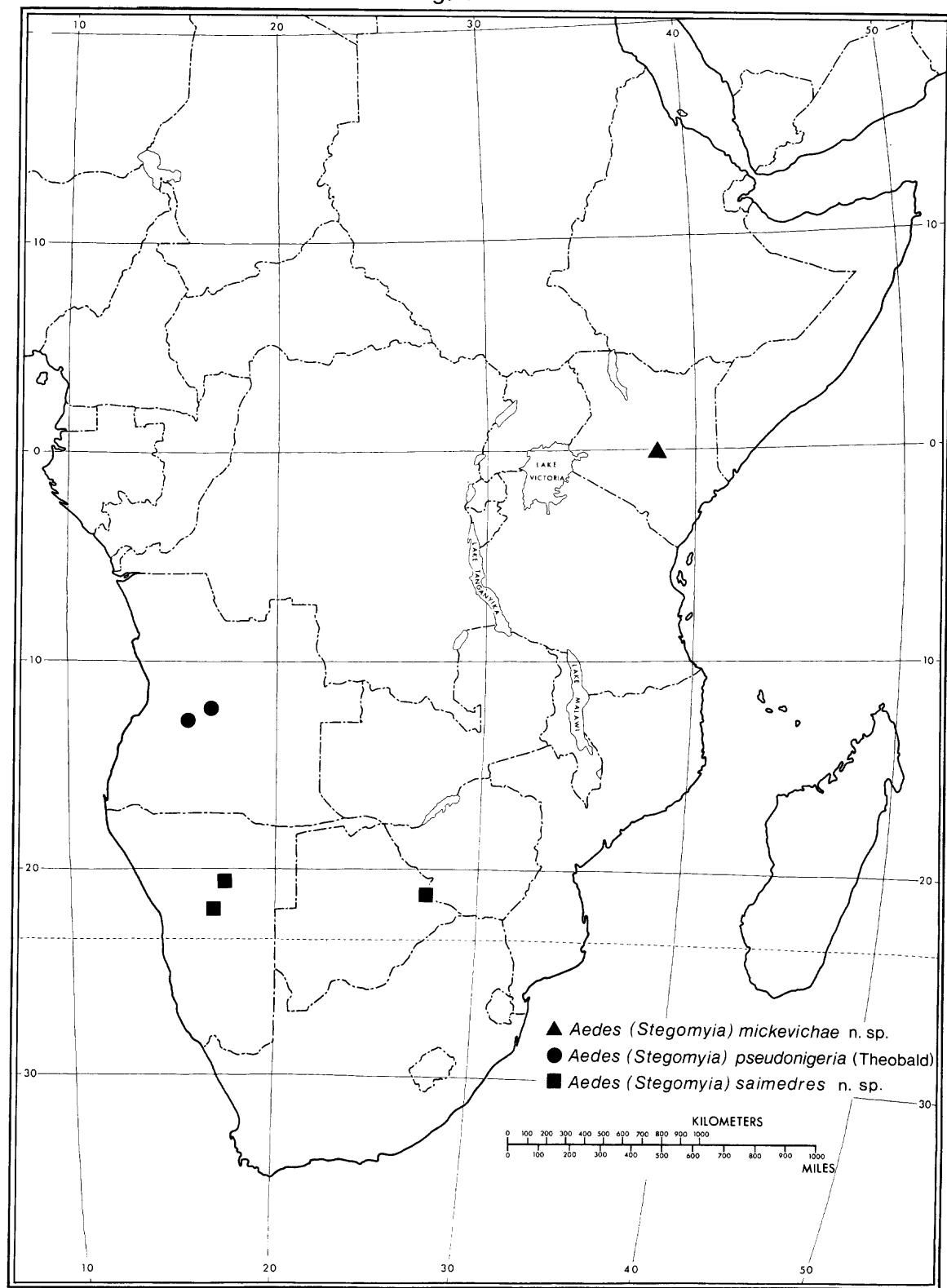
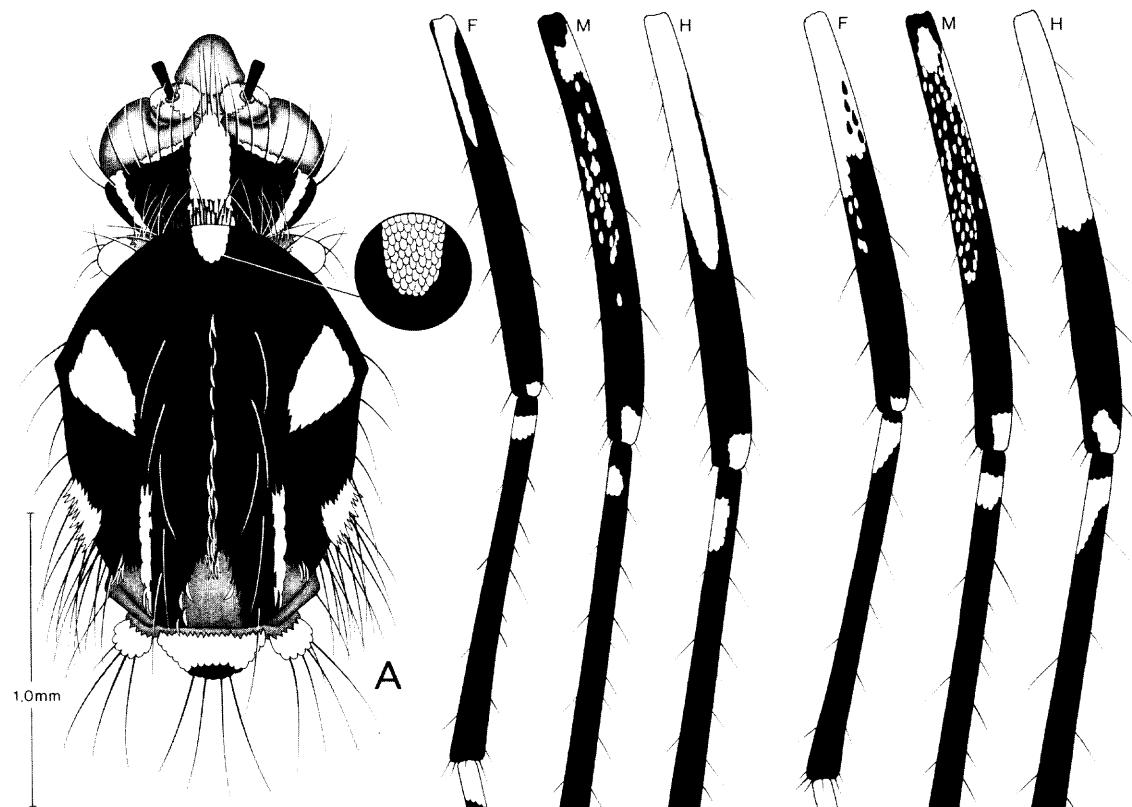
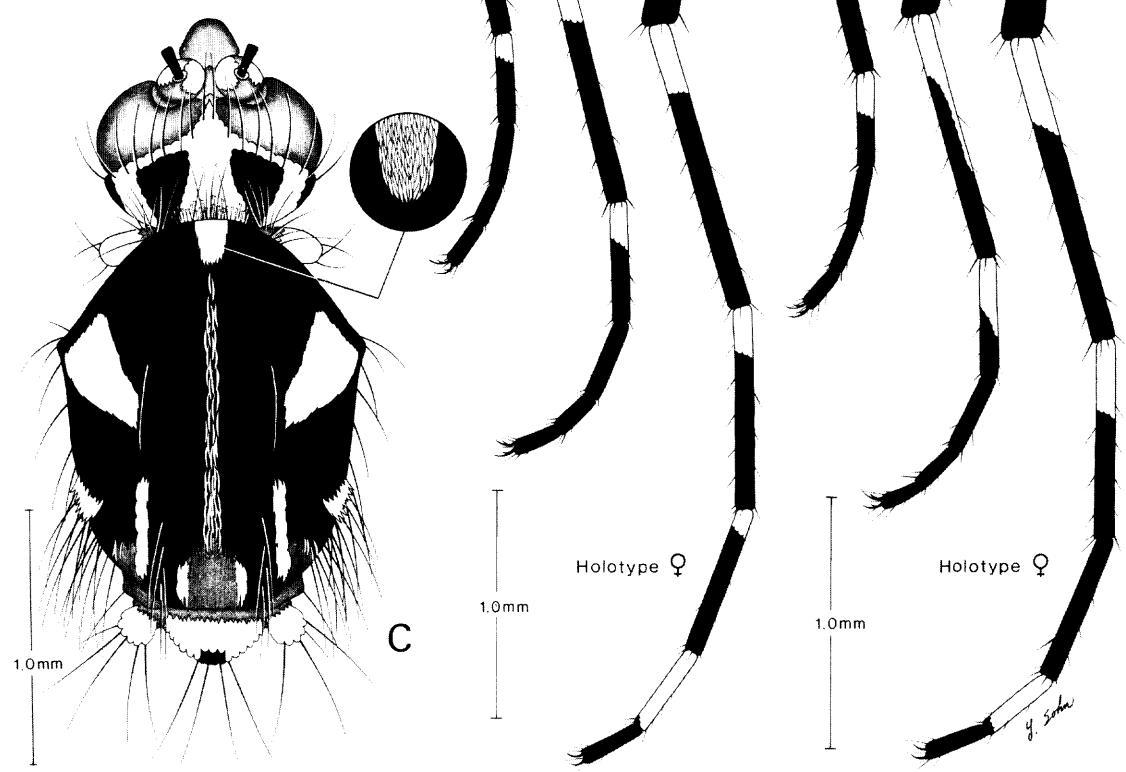


Fig. 2



Aedes (Stegomyia) saimedres n.sp.

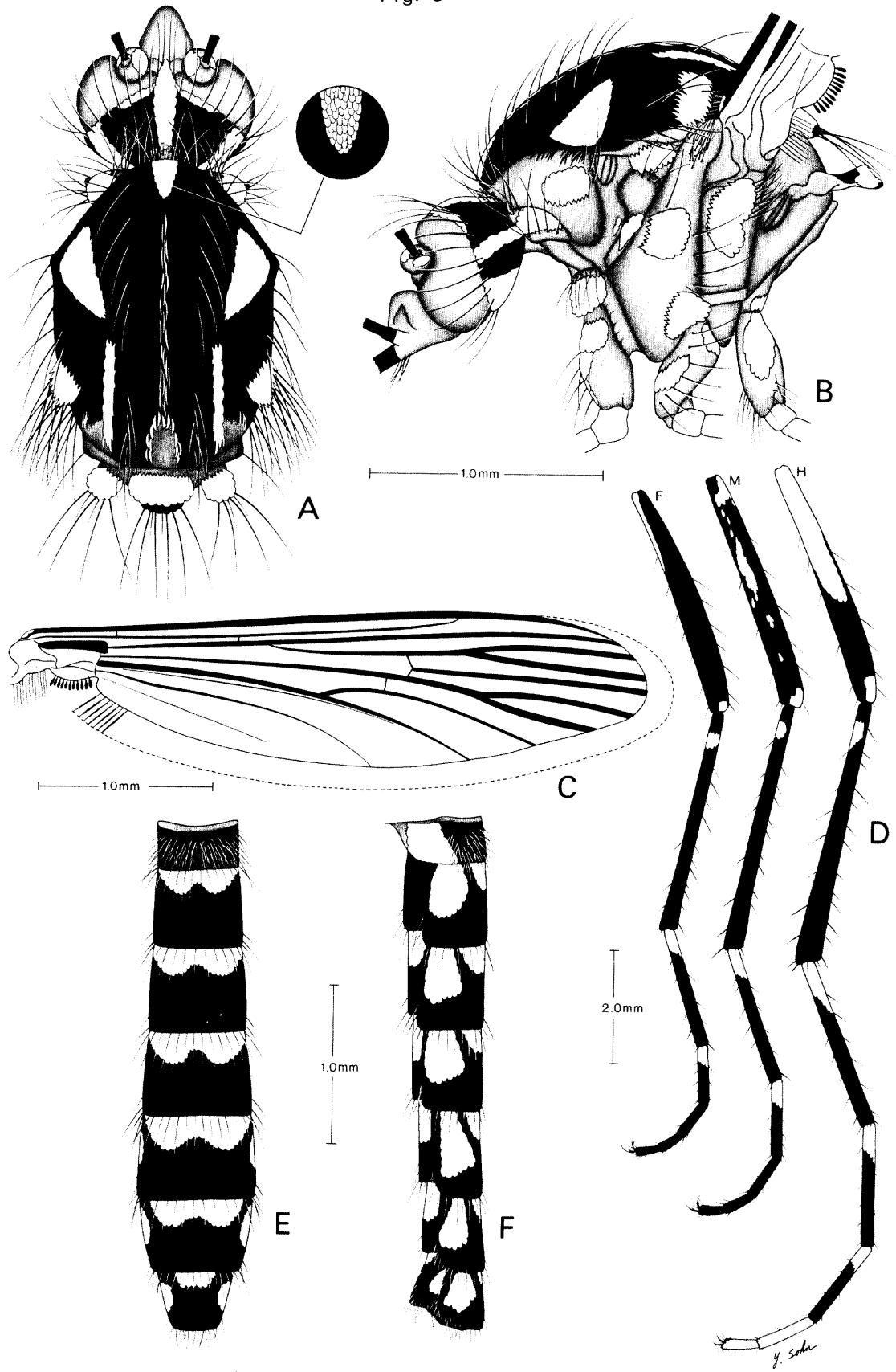


Aedes (Stegomyia) mickevichae n.sp.

saimedres n.sp.

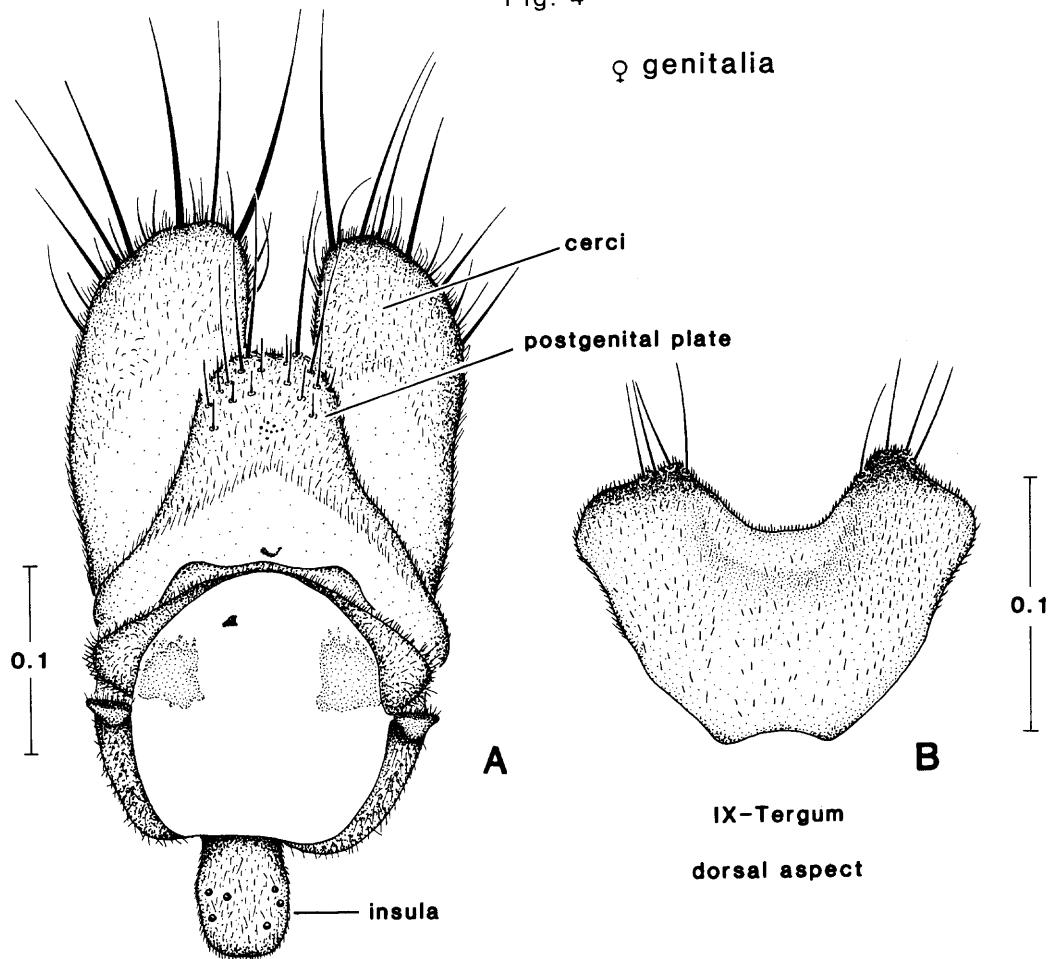
mickevichae n.sp.

Fig. 3



Aedes (Stegomyia) pseudonigeria (Theobald) ♀ (Type)

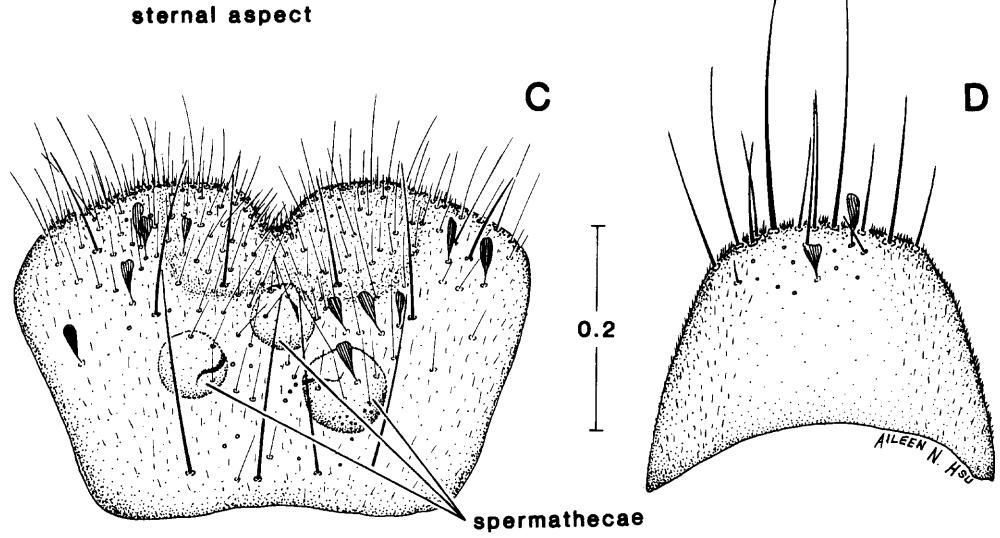
Fig. 4

 φ genitalia

IX-Tergum

dorsal aspect

sternal aspect



VIII-Sternum

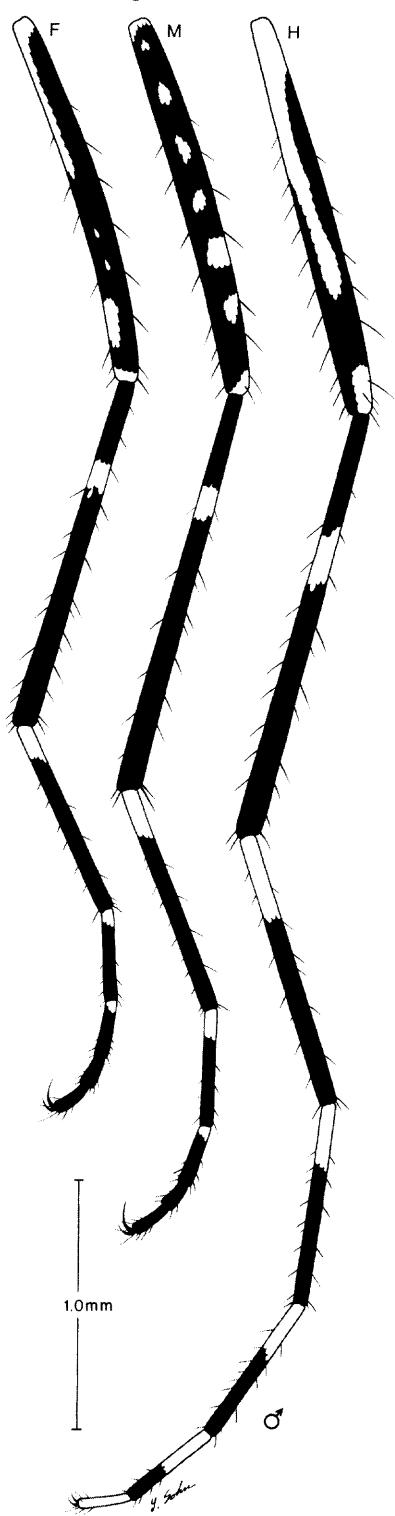
dorsal aspect

VIII-Tergum

dorsal aspect

Aedes (Stegomyia) salmedres n. sp.

Fig. 5



Aedes (Stegomyia)
chemulpoensis Yamada